# Athena Student Interns Program: Application

NASA is committed to helping develop and inspire the next generation of explorers, scientists, engineers, and researchers. Now NASA wants to involve YOU in the excitement of Mars exploration and discovery! The **Athena Student Interns Program (ASIP)** is a unique opportunity to become part of the Athena Science Team for the 2003-2004 Mars Exploration Rover Mission. From around the country, selected teachers and their chosen students will work with scientists to prepare for rover operations, analyze data during the mission, and reach out to other students, teachers, and the public through presentations, articles, and web sites. Following months of preparation and special training, teachers and students will spend one week in mission control during landed operations to help explore the surface of Mars. It could be you!

**Remember:** The most important requirements are
enthusiasm, excitement, and dedication!

This document includes the following sections:

**Section 1:** Requirements
**Section 2:** Mentor Descriptions
**Section 3:** Signature Form
**Section 4:** Application Form

Please read the requirements for participation and mentor descriptions carefully. **All applicants** must fill out and mail in the signature page. The actual application may be submitted either via the online form or by mailing a hard copy.

## 1. REQUIREMENTS

**Participants:**

- 1 Teacher and 2 Students per Team
- All **must be** U.S. Citizens

All high school teachers in the United States, including U.S. possessions and schools operated by the U.S. for the children of American personnel overseas, are invited to apply. Each teacher selected to the program will choose two students currently in grades 9, 10, or 11 to participate actively in ASIP. Since this program is designed to expand students' horizons and encourage them to pursue studies or careers in science, technology, engineering and math, we ask that teachers select students who have not had other similar experiences and for whom the program would be particularly high impact.

**Time Commitment:**

- April 2003-April 2004;
- Once a week interaction with the Program*;
- Once a week work as a small group (as necessary);
- Varied outreach activities (see Outreach section)

- 1 week spent at the Jet Propulsion Laboratory between January and April 2004. (Travel for the teacher and two students will be paid by the Program)

The program runs from April 2003-April2004. During this time, participants will be expected to interact with ASIP staff or mentors on a weekly basis (although the summer schedule may vary). Twice a month, teachers and students will participate in teleconferences or web-based videoconferences where scientists, engineers, and program staff will present background information on Mars, rovers, geology, and missions(*). Two additional times per month, teachers and students will work with their mentor, either in person at the mentor's institution, or via telephone or email. Each teacher/student team will also be expected to meet on their own, as needed, to learn material or accomplish projects or outreach activities.

* **NOTE:** Due to scheduling and time zone difficulties, these meetings may take place during the school day. We do our best to minimize interruption, but request the cooperation of the school in letting the students fully participate.

**Technology**:**

- Daily access to email (both students and teacher);
- At least 1 Internet-connected PC computer with the configuration below;
- Access to a telephone that can dial 1-800 numbers and has a speaker phone
- Web-based videoconferencing hardware and software (provided)
- Support of a school technology/computer officer or administrator

Email:
Both the teacher and the students should have daily access to email during the week since updates are sent out on a very regular basis and often require a response. Either school or personal accounts (such as Hotmail) are acceptable.

Computer:
The absolute MINIMUM computer required to run the rover science software SAP (Science Activity Planner) will have the following specifications:

- PC running Microsoft Windows 98 or higher
- Pentium 3, 500 MHz processor
- 256 MB of RAM
- Sound card
- Modem and Internet connection
- 2 GB of free disk space

The IDEAL computer would have the following specifications:

- PC running Microsoft Windows 98 or higher
- Pentium 4, 1.5GHz processor or faster
- 1GB or more of RAM
- GeForce3 graphics card or better

- Sound card
- Cable modem/DSL or faster Internet connection
- 7200 RPM ATA/100 disk drive with at least 2GB of free disk space

Anything in between will work and if you are planning to upgrade from the minimum computer configuration, we can provide you with suggestions on which aspects are the most important and how to update your graphics card.

Phone and Videoconferencing:
Students and teacher will need access to a phone that can dial 1-800 numbers and has a speakerphone in order to participate in teleconferences. Hardware and software for web-based videoconferencing will be provided and should run on the "minimum" requirement PC described above.

Technology Support
In the past, there have been problems with school firewalls that prevent student teams from using the special rover science software. To avoid this, please include your school's technology officer or computer administrator in your plans for the program.

****NOTE:** If these technology requirements present a special hardship for your school, please include a letter describing the situation.

**Outreach:**

- At least 3 presentations to classes
- At least 2 presentations to the school
- At least 2 presentations to the community
- Weekly web diary of lessons learned, accomplishments, and discoveries
- Participation in 1-2 national webcasts
- Contributions to publications such as web articles, conference abstracts, etc.
- Teachers will contribute to the development classroom activities to help others bring Mars into the classroom and will help test previously developed classroom activities

Although there are only a moderate number of students directly involved in the Athena Student Interns Program, the program is designed to bring the excitement of Mars exploration to as many others as possible through outreach done by ASIP participants throughout the program. Each group will need to commit to doing at least three presentations to their class at school; at least two presentations to the school through assemblies or a series of class presentations; and at least two presentations to the local community, either through a science center or museum, a community or church group, or other local event. Additionally, each team will be asked to keep a weekly diary of their progress to give others a "behind-the-scenes" glimpse of what it's like to be part of a mission. Students and teachers will participate in one or two national webcasts about the mission and will contribute to articles written about the program and the mission for web- and print-based publications and conferences. Teachers are asked to contribute to the development of classroom activities relating to the mission and the Athena Science

Payload over the course of the program and to help test previously developed activities in their classrooms.  Program staff will be coordinating these outreach activities.

## 2. MENTOR DESCRIPTIONS

In the Athena Student Interns Program, scientists from the Athena Science Team act as mentors to the students and teachers, involving them in research and projects associated with the Mars Exploration Rover mission. Please read the mentor descriptions below to determine the team to which you would like to apply.

"Geographic Proximity Required" means that you and your students must be close enough to the mentor's institution to be able to travel to the site at least twice a month to work in a lab, meet with the mentors and colleagues, and prepare for the mission. This is due to the specialized/unattainable equipment required by the mentors' work.

"Open Nationwide" means that you and your students can be located anywhere in the United States, including U.S. possessions and schools operated by the U.S. for the children of American personnel overseas. The mentors' work does not require specialized/unattainable equipment.

| **GEOGRAPHIC PROXIMITY REQUIRED** | | |
|---|---|---|
| **Name** | **Location** | **Project** |
| Dr. Nathalie Cabrol | NASA ARC<br>Moffett Field, CA | Help to deduce the properties of sediments, and the nature of the transporting agents and depositional environments. |
| Dr. Wendy Calvin | University of Nevada<br>Reno, NV | Work with data from the mini-TES instrument to identify mineralogy and rock types at the landing sites. |
| Dr. Larry Crumpler | NM Museum of Nat. History and Science<br>Albuquerque, NM | Map individual scenes, count the numbers of certain objects in an image, and work with digital models of the terrain. |
| Dr. Thanasis Economou | University of Chicago<br>Chicago, IL | Work with spectral data to derive the chemical composition and mineralogy of martian rocks |
| Dr. Bill Farrand | University of Colorado<br>Boulder, Colorado | Contribute to the determination and understanding of the physical properties of rocks and soil-like materials sampled |
| Dr. John Grotzinger | MIT<br>Cambridge, MA | Assess the role of microorganisms in creating textures preserved in rocks from the geologic history. |
| Dr. Jeff Moersch | University of Tenn.<br>Knoxville, TN | Target spectral observations with the mini-TES (thermal emission spectrometer), and helping to reduce spectral data. |
| Dr. Paulo Souza*** | Brazil*** | Help analyze Mössbauer spectral data to understand Mars geology and look for clues of past water on Mars |
| Dr. Steve Squyres | Cornell University<br>Ithaca, NY | Work as assistants to the Principal Investigator on issues from day-to-day rover operations to press conferences. |
| Dr. Tom Wdowiak | University of Alabama<br>Birmingham, AL | Study Earth-related science in the lab to get familiar with what types of things to look and analyze Mars data. |
| Dr. Albert Yen | Jet Propulsion Lab<br>Pasadena, CA | Understand the chemistry and mineralogy of martian dust and soil. |

***Note: U.S. Citizenship is required of all participants (teacher and students).

| **OPEN NATIONWIDE** | | |
|---|---|---|
| **Name** | **Location** | **Project** |
| Dr. Ray Arvidson | Washington University<br>St. Louis, Missouri | Work on use of the rovers as geophysical instruments that sample the topography and soil properties during traverses. |
| Dr. Mike Sims | NASA ARC<br>Moffett Field, CA | Research on doing rover operations for science and the tools that enable those operations. |
| Dr. Mike Wolff | Augusta, Georgia | Computer modeling of atmospheric data. |

**Dr. Ray Arvidson**

**Role:** The overall objective is to synergistically use all of the Athena observations and the rover telemetry data to address the nature and extent of interaction of crustal materials and water. As Deputy Principal Investigator, Dr. Arvidson will spend time as a Science Operations Working Group chairman, oversee experiments to determine the physical properties of rocks and soils, lead analysis of rover traverse telemetry to infer terrain properties, help coordinate orbital and rover observations, provide backup to the Principal Investigator, and lead the archiving team, ensuring that data produced during the mission are documented and delivered to the Planetary Data System in a timely manner.
**Student Research:** Work on tasks that contribute to the determination and understanding of the physical properties of rocks and soil-like materials sampled during the Mars Exploration Rover mission. Specifically, the students will work on use of the rovers as geophysical instruments that sample the topography and soil properties during traverses.

**Dr. Nathalie Cabrol**

**Role:** During the mission, Dr. Cabrol will identify the materials transported and deposited by water at the Mars Exploration Rover mission sites and place them in the context of the MOC (Mars Orbiter Camera) and MOLA (Mars Orbiter Laser Altimeter) data; analyze their sedimentary characteristics (distribution, shape and size of sedimentary grains); identify the processes involved in their transportation and deposition; and assist the Panoramic Camera and Microscopic Imager teams for data analysis, data archival, and identification of science targets.
**Student Research:** Students will start with sedimentary analysis on Earth using the 3 dimensions of rocks, sedimentary grains, pebbles, etc and a variety of techniques (e.g., sieving) that are not available while using a robotic vehicle on another planet. Tests focused on how to measure sediments and sedimentary rocks are being developed right now that will allow us to calibrate the results that we will obtain using the MER instruments. The students will participate in these tests before the mission. During the mission they will help in compiling the data, establish the morphometrical and statistical analysis of Panoramic Camera and Microscopic Imager images that will help to deduce the properties of sediments, the characteristics of their emplacement, and the nature of the transporting agents and depositional environments. Students will also assist with the generation of graphical and statistical material that will allow easy access and combination of the results of this investigation with those of other instrument teams and science investigators, and their archival. It will be helpful if the students know how to use or can quickly learn Microsoft Word and Excel and, if possible, NIH Image and Adobe PhotoShop.

**Dr. Wendy Calvin**

**Role:** Dr. Calvin will be working primarily with data from the mini-TES instrument to identify mineralogy and rock types at the landing sites. This involves comparisons with both field and lab data of terrestrial analog materials, as well as defining methods to accurately remove the atmospheric contribution to the spectra.

**Student Research:** The students will be involved with both field studies and computer analysis of analog spectra including: 1) mineral un-mixing using library spectra, 2) incorporation of measured spectra into libraries, 3) collection of new analog materials at various sites within the State of Nevada and 4) forward modeling of existing orbital TES data using new mineral analogs.

**Dr. Larry Crumpler**

**Role:** Dr. Crumpler is a field geologist and a planetary geologist, so the MER mission blends both his backgrounds. On the MER mission he plans to prepare a map record or field geologist's notebook regarding the geological characteristics that the rovers encounter. This may be accomplished as a single map, a map of the panoramic camera images and microscopic images at each field stop, or something more tabulated. His plan is to produce maps based on mapping in the Pancam and Microscopic Imager images.
**Student Research:** Students will help map individual scenes, count the numbers of a particular object in an image, and work with rover engineers to extract useful geological measurements from the navigational camera-generated digital terrain model.

**Dr. Thanasis Economou**

**Role:** Dr. Economou is a Co-Investigator for the APXS (Alpha Particle X-Ray Spectrometer) that is part of the Athena Science Payload. He will be working primarily with the APXS and, to some extent, with the Mössbauer Spectrometer data on the MER mission to derive the chemical composition and the mineralogy of martian soil samples and rocks. He has extended experience in that area since he designed the x-ray part of the APXS on the Pathfinder mission that provided the result of the chemical analyses of the Pathfinder lander site.
**Student research:** The students will be trained to use the proper tools to analyze the flight data from the MER mission and to interpret the results. They will also be involved in the laboratory to obtain APXS-like spectra using a Pathfinder-type APXS instrument in the mentor's lab and analyze real terrestrial rocks. The students will be encouraged to familiarize themselves with the rest of the MER payload and the MER mission.

**Dr. Bill Farrand**

**Role:** Dr. Farrand will be working with the Mineralogy and Geochemistry Science Theme group to identify the minerals and rocks present at the MER landing sites. A primary focus is to characterize the landing sites in terms of major components, the most widely distributed rocks and soils, and minor or anomalous components, rocks or soils, which have only limited outcrops or occurrences. In order to achieve this objective, he will be applying a set of specialized data processing algorithms to data from the Pancam and Mini-TES instruments. Data from these instruments will be compared to similar measurements of rocks and minerals from Earth.
**Student Research:** The students will help out with the assembling and cataloging of spectral libraries, running processing algorithms on the data to help match data from the instruments to the spectral libraries, gathering statistics on materials classified in the images, and helping to prepare materials for presentations.

**Dr. John Grotzinger**

**Role:** Dr. Grotzinger will be working in Long-Range Planning. The objective is to steer the mission to insure that it meets its scientific goals as well as NASA's goals, which define technical success. In addition, Dr. Grotzinger will be working on the scientific goals by looking at images for signs of geological processes that would be consistent with the presence of fossil life, or the traces of biological processes. His contribution will be to provide experience based on looking at textures formed on the early Earth, when only microorganisms were present.
**Student Research:** Work on projects designed to assess the role of microorganisms in creating textures preserved in rocks from the early part of earth history and how that relates to rocks on Mars. This would involve studying rocks in the lab using a variety of imaging techniques.

**Dr. Jeff Moersch**

**Role:** Dr. Moersch's primary scientific objective is to use Mini-TES data to identify minerals that formed in water-rich environments. As a secondary objective, orbital data from the Mars Odyssey Thermal Emission Imaging System (THEMIS) instrument will be used to produce compositional maps that will aid in landing site selection, set the geologic context for the MER surface investigations, and aid in strategic planning for rover traverses. Another secondary objective is to use Mini-TES observations to calibrate and validate orbital remote sensing data.
**Student Research:** Students will help target spectral observations with the mini-TES (thermal emission spectrometer), help reduce spectral data, and prepare figures for presentations. It will be helpful if the students are highly comfortable with computers and if they had skills using programs such as Microsoft Excel, Adobe Illustrator, or similar computer software.

**Dr. Mike Sims**

**Role:** Dr. Sims' role with the Mars Exploration Rover is in the arena of rover operations for science and the tools that enable those operations. Specifically, his work has lead to tools like the software, Viz (a 3D visualization of a science scene), other image processing and visualization tools, and Sol Trees (a way to organize activities done during martian days)
**Student Research:** Students will be involved in using these tools and possibly in programming focused computer programs. Comfort with computer tools is important but programming experience is not essential. Help in preparation of on-line tutorials on using these science and operations tools is also possible.

**Dr. Paulo Souza**

**Role:** Dr. Souza's primary scientific objective is to use Mössbauer Spectrometer data to identify iron-bearing minerals that formed the Martian surface (soil and rocks). He will be working to use a set of intelligent data processing algorithms to extract Mössbauer

parameters of analyzed targets on Mars (i.e. finger-prints of minerals). Those minerals can help produce a better understanding of Mars geology and provide clues for past weather on Mars. The implemented data processing routines use artificial neural networks, genetic and evolutionary algorithms and fuzzy logic to interpret the Mössbauer data.
**Student Research:** Students will actively help with the analysis of Mössbauer spectral data, record findings of the neural analysis system, study basics of resonance methods and the physics of Mössbauer spectroscopy (all training will be provided). The students will help format data products and prepare slides for scientific discussions during the mission. Prior the mission, the students will get know to many "terrestrial" applications of Mars technology. A copy of the flight miniaturized Mössbauer spectrometer is being used at CVRD (Dr. Souza's home institution in Brazil) for air pollution studies, corrosion and quality control of iron-bearing mineral products.

**Dr. Steve Squyres**

**Role:** Dr. Squyres is the Principal Investigator of the Athena Science Payload. He will be in charge of leading the team of scientists, working with the rover engineers, and making decisions that affect the movement of the rovers and the science accomplished.
**Student Research:** Assist the Principal Investigator, working on issues ranging from day-to-day rover operations to preparation for press conferences.

**Dr. Tom Wdowiak**

**Role:** Dr. Wdowiak has had much experience with the use of the Mössbauer Spectrometer attached to the robotic arm. Besides obtaining iron mineralogical data on rocks, soil and dust, he will be working to recognize things in the data that might indicate the past presence of water and ancient environments like hot springs and volcanic activity.
**Student Research:** Actively collaborate in the study of Earth-related science in the lab to get familiar with what types of things to look for on Mars. Participate in the analysis of data sent from Mars and help write scientific papers.

**Dr. Mike Wolff**

**Role:** Dr. Wolff will be doing highly computer-related tasks working with algorithms to help with analysis of atmospheric data. He will work with the Atmospheric Team to derive results from comparisons to computer models.
**Student Research:** The atmospheric team will be deriving its results from comparisons of data to computer models and students will assist in that. Some experience with or interest in computer programming and mathematics would be helpful.

**Dr. Albert Yen**

**Role:** The focus of Dr. Yen's scientific research to understand the chemistry and mineralogy of martian dust and soil. He plans to use data from the APXS (Alpha Particle

X-Ray Spectrometer) and Mössbauer spectrometer to identify likely soil formation processes and to constrain the quantity of meteoritic material that might be present at the martian surface. Dr. Yen also supports daily rover operations in a variety of roles including science planning, instrument commanding, and telemetry analyses.
**Student Research:** Students will have the opportunity to participate in one or more of the following activities: Health trend analyses of the APXS and/or Mössbauer spectrometer, chemical and mineralogical interpretations of the APXS and/or Mössbauer spectrometer data, planning of science activities, coordination of uplink and downlink events, and preparation and characterization of laboratory samples for comparison against the flight instrument data.